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Effective Teaching and Learning of Science in the Outdoors: A Blended Model

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Abstract

This paper reports on an innovative Continuing Professional Development (CPD) programme which addressed transition issues and issues with conducting outdoor work and attitudes towards science through 'Shared Learning' days between elementary and middle school transition classes. Teachers supported each other to overcome issues with conducting outdoor work and contributed their expertise from their educational stage. The project utilised a blended CPD approach of workshops, coteaching and in-class support and was based upon a wealth earlier successful CPD programmes to result in a sound theoretical framework.

The outcomes were measured using a thorough mixed-methods approach. This paper will report on the achieved outcomes with effective outdoor learning as the vehicle to overcome identified issues and key challenges for policy development.

Objectives/purposes:

As we come to the end of the United Nations Decade of Education for Sustainable Development (2005-14: UNESCO, 2005) current policy directives and curriculum changes throughout the UK can be seen to be offering opportunities for the development of outdoor learning. However, these have not been reflected in policy change in Northern Ireland (NI), the context for the current study, where there has been a substantial revision in the curriculum after many years of prescribed content to give teachers the flexibility to modify the curriculum to remove barriers to learning and meet the needs of all learners.

An "explicit emphasis on the development of skills" is at the heart of the NI curriculum for the purposes of lifelong learning and "operating effectively in society" (CCEA, 2007, p. 5). The impact of such curriculum change cannot be understated and is seen as overwhelming for many, coupled with changes in how science is taught (previously science was taught as a subject on its own but now must be taught with history and geography as part of 'The World Around Us' learning area). For example, a case study of NI's curriculum review reported that teachers were frustrated by being "forced to respond to too much change too quickly" (Gallagher, 2009, p.1). A report entitled Curriculum overload in Primary Schools: An overview of National and International experiences also stated that "the

curriculum autonomy and flexibility allowed to schools while alleviating the overload issue, can ironically, also contribute to it.” (NCCA, 2010, p.37).

There is ongoing concern that teachers’ lack of confidence in science has led to their ignoring science and concentrating on teaching only history and geography (Addis, Reid, McAlister and Shine, 2007) and has led to a call for ongoing professional development in the area to meet the challenges of delivering all three subjects (science, history and geography) in a blended way. Outdoor learning is often referred to as a way to engage, enthuse and teach children about the world around them - the use of places other than the classroom “help us to make sense of the world around us” (DfES, 2006, p.1).

However, outdoor learning is not without its challenges for teachers, schools and children. Research in the area of outdoor learning specifically has also identified real and potential issues for schools, teachers and students. Dillon, Rickinson, Teamey, Morris, Young Choi, Sanders and Benefield, (2006) reported on the key findings from a critical review of 150 pieces of research on outdoor learning and site issues such as prior knowledge and experience, fears and phobias, health and safety issues, learning styles and preferences (Dillon *et al.*, 2006).

Around the globe, transition in schooling present real difficulties and a “puzzling terrain to traverse” to the extent that many students “unlearn” skills and content (Andrews and Bishop, 2012, p.8). Transition is cited as a stressful and anxious time for all pupils, even those who would adjust well to their new school, and the effects of a poor transition can include psychological problems and temporary or ongoing attainment issues (Rice, Frederickson & Seymour, 2011). It is also important to note that transition between elementary and middle school occurs at a time when pupils of this age are experiencing significant social, emotional, cognitive, and physical changes which can intensify the transition experience (Andrews and Bishop, 2012).

In short, transition issues are often characterised as academic and/or social with an increasing number of scholars in the area citing both as having due weight in terms of impact for children and young people (Andrews and Bishop, 2012; Mackenzie, McMaugh and O’Sullivan, 2012.) With specific reference to NI, Mullan (2014) comprehensively considered the social and academic impact of transition among children in the pre and post transition year groups as well as their preferred collaborative approach in helping them to settle into school. Based on his findings from surveys of pupils and teachers he recommended that effective transition can be achieved through collaborative programmes which address both social and academic development and transition (Mullan, 2014).

Thus far, this paper has outlined contemporary issues faced by educators:

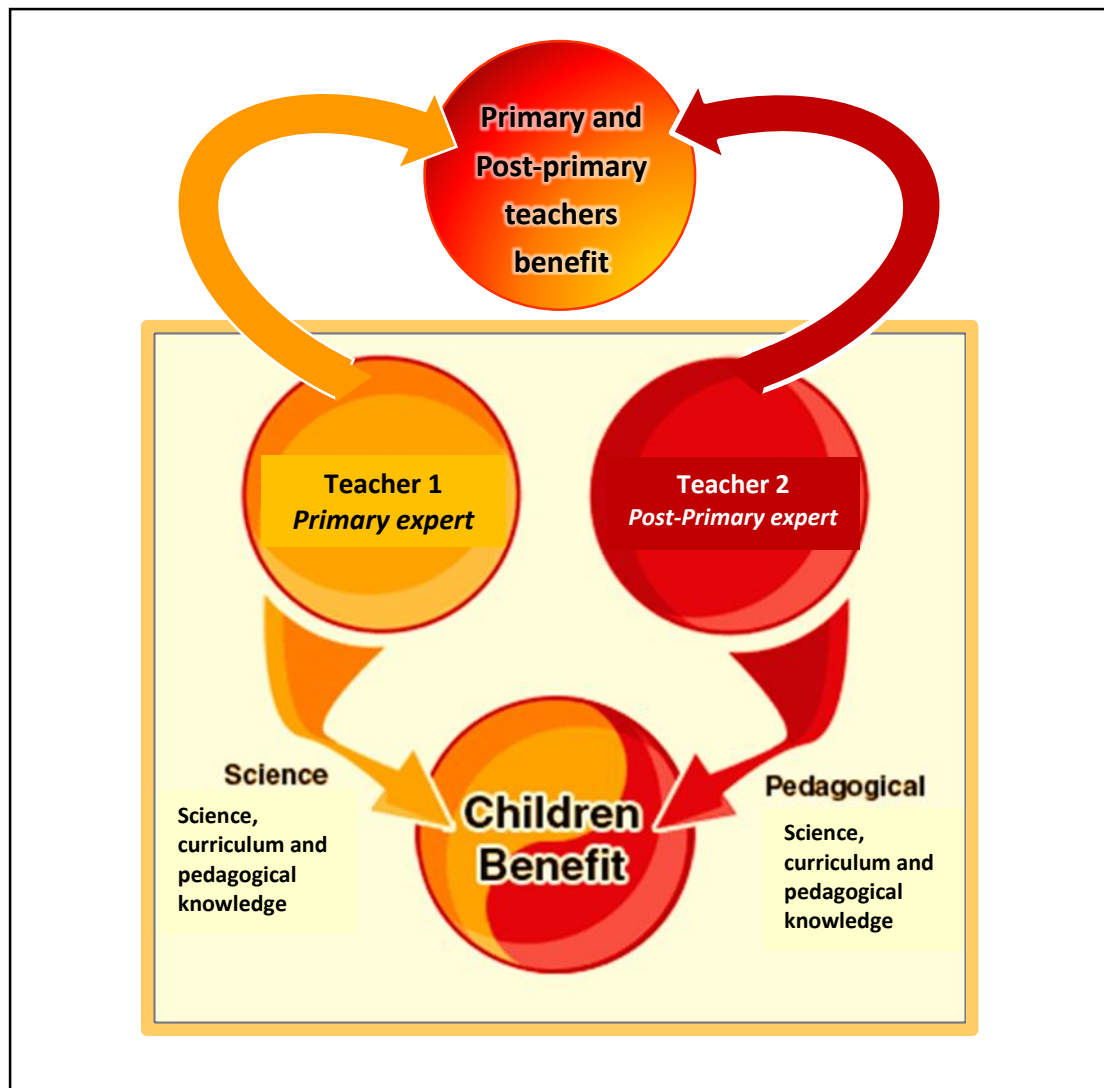
- curriculum change, particularly in relation to science;
- the expectation of greater autonomy and skills-based approaches;
- confidence in teaching and learning science and teaching and learning in the outdoors and;
- social and academic transition issues for children moving between elementary and middle school.

Having identified these issues both internationally and in the current context, the author designed a programme model to address these issues which incorporated a blended CPD programme through teacher workshops, in-class support and the planning and completion of 'Shared Learning' days in the outdoors between middle schools and one of their 'feeder'¹ elementary schools.

Perspective(s) or theoretical framework:

The project model was based upon recent work which has benefitted from a wealth of earlier successful CPD programmes (Kerr, 2010; Murphy and Beggs, 2010; Murphy and Scantlebury, 2010). The carefully designed model aimed to address the identified issues through a blended model of specifically designed CPD and in-class support which met the core criteria from an extensive review of CPD approaches ("active participation, focusing on the needs of specific teachers and pupils, working together, reflection, presentation of work and a long term/on-going element": Kerr, 2010, p.155). Figure 1 presents this extension with the inclusion of CPD workshops, coteaching and in-class support as a backdrop and the recognition within the model that both the elementary and middle school teachers mutually benefit from this blended CPD approach.

¹ In this context a 'feeder' school is one of the elementary schools from which children will transfer into the partner middle school



□ CPD workshops and in-class support

Figure 1: A blended CPD model for coteaching and learning science in the outdoors (built on the original model by Murphy and Beggs, 2010)

The roll out of this model and its components was rigorously evaluated. The methodological background/research strategy and methods are outlined in the next section.

Methods, techniques, or modes of inquiry:

Rickinson, Dillon, Teamey, Morris, Young Choi, Sanders and Benefield (2004, p.17) outlined the trends within research on outdoor learning over the past two decades which have culminated in the surfacing of more critical explorations of “the conceptual and theoretical aspects”. The journey of research in the area generally aligns to the development of social science research more broadly – from quantitative pre-post and post-test designs to look at the impact of outdoor interventions in the early 1990s to meta-analyses calling for a more in-depth look at the processes of outdoor learning in the

mid-1990s which resulted in more qualitative and mixed-methods studies at the turn of the decade (Rickinson *et al.*, 2004). The current study embraced the best practice in research design in the area of outdoor learning over the past two decades by engaging in a critical exploration of the conceptual and theoretical aspects of outdoor learning through the use of a tried and tested mixed methods approach.

When considering the impact and possible effects of outdoor learning, Rickinson *et al.*'s (2004) categorisation of the impacts reflects what is outlined in the literature: cognitive, affective, interpersonal/social and physical/behavioural impacts. With carefully designed pre and post testing across various impact categories as well as in-depth interviews and focus groups with those involved (children and teachers) this study examined the outcomes of a blended model of co-planning, coteaching and co-evaluation through shared learning and teaching days in the outdoors across the transition phase.

Teachers from four elementary and four middle schools in NI took part. Two teachers worked together (one elementary and one middle school science teacher) to co-plan, co-teach and co-evaluate 'Shared Learning' days in the outdoors with their two class groups. In total, there were four coteaching teams and a total of 180 children took part.

Data sources, evidence, objects, or materials:

Methods of data collection included children's questionnaires and focus groups as well as teacher interviews, reflective diaries (completed before, during and after the project). Throughout the project the teachers and children also recorded their activities in the form of photographs, videos and presentations.

The children's questionnaire was given particular attention in terms of adaptation with a particular emphasis on trialling a suitable questionnaire for evaluating teaching and learning in the outdoor classroom in future projects. The children's questionnaire sections adapted from well-known work in the area: attitudes to school science (Kerr, 2008), perceptions of independence and teamwork and attitudes to learning science outside (both adapted from Amos and Reiss, 2011), views on sustainability adapted (Manoli, C., Johnson, B., and Dunlap's, 2008) as well a newly developed measure on attitudes towards transition.

The post-project questionnaire included additional reflective items on the project and the shared learning days. Focus group (children)/interview (teachers) questions were related to outdoor learning (enjoyment, usefulness), transition, coteaching, sustainability and improvements.

Data from the interviews and focus groups were themed and categorised in line with the four categories of outcomes/impacts outlined in the literature: cognitive, affective, interpersonal/social and physical/behavioural.

Results and/or substantial conclusions or warrants for arguments/point of view:

Cognitive outcomes

These are defined as academic outcomes to include knowledge and understanding (Rickinson *et al.*, 2004). For the teachers, knowledge and understanding of several aspects was developed through the programme: the level and content of science covered in the coteacher's educational stage, their own science subject knowledge and skills and knowledge of how to teach outdoor learning activities and use appropriate resources. The children's science subject knowledge and understanding also increased as did their knowledge and awareness of transition and what it is like to attend the other school.

Affective outcomes

Affective outcomes are defined as incorporating 'attitudes, values, beliefs and self-perceptions' (Rickinson *et al.*, 2004, p.15). For teachers, these included empowerment and confidence to teach science in the Revised Curriculum and in the outdoors – their enthusiasm and enjoyment for teaching in this way was also evident. The children's attitudes to science also evidenced an increase and their enthusiasm for working with children in the other transition phase.

Interpersonal/social outcomes

Interpersonal/social impacts are said to include communication skills, leadership and teamwork (Rickinson *et al.*, 2004). The teachers focused on their development as a result of planning/teaching together (coteaching) which led to them being more autonomous when teaching science in the outdoors, their relationships and communication with their coteachers was also of great benefit for sharing ideas and professional development. These relationships also helped build transition links between schools and teachers. For the children, the social aspect and the opportunity to work in teams with other children in the transition phase led to sharing experience, making friends, and reassurance about middle school as well as being more positive about middle school science.

Physical/behavioural outcomes

Physical/behavioural impacts are related to 'physical fitness, physical skills, personal behaviours and social actions' (Rickinson *et al.*, 2004, p.15). Long term and sustainable change to the practice of teaching science and science in the outdoors was evidenced by all the coteachers and schools

including whole school planning changes and support at leadership level. All schools continued the work with new children in subsequent years. The children evidenced changes to their personal behaviours and actions in relation to the environment and its sustainability and were more aware of the damage being caused to the environment as a result of human actions. The children's independence and ability to work in teams also evidenced improvement.

More detailed findings, including indicative quotes and quantitative data relating to the specific issues outlined in this paper (curriculum change, the expectation of greater autonomy and a skills-based approaches, confidence in teaching and learning science and science in the outdoors, social and academic transition issues for children) will be presented in the final paper under each of the outcome types (cognitive, affective, interpersonal/social and physical/behavioural).

Scientific or scholarly significance of the study work:

The findings inform future practice with regard to the use of an innovative, carefully designed, blended CPD approach utilising coteaching across the elementary/middle school transition phase. This study provides a real proof of concept for teaching and learning science in the outdoors to inform policy debates in support of outdoor learning as a vehicle to address contemporary issues in relation to curriculum change, teacher confidence, attitudes to learning and teaching outdoors as well as transition issues.

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